



# Department of Computer Science

ANNUAL  
REVIEW

2009

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A summary of the activities of the Department in 2009



UNIVERSITY OF CAPE TOWN  
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

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## ABOUT US

### Overview of the Department

Administratively and academically, the department is in the Faculty of Science at The University of Cape Town.

From a teaching perspective, we offer the following fulltime programmes:

- Bachelor of Science - a 3-year undergraduate degree
- Bachelor of Science Honours - a 1-year postgraduate degree
- Masters in Computer Science (MSc/MPhil) - a 2-year research training degree
- Masters in Information Technology (MSc/MPhil) - a 2-year conversion course
- PhD in Computer Science - a 3-year research degree

Our research is conducted largely within the auspices of seven research groupings or laboratories:

- Advanced Information Management (AIM)
- Advanced Telecommunications Research (ATR)
- Collaborative Visual Computing (CVC)
- Data Network Architectures (DNA)
- Digital Libraries (DL)
- High Performance Computing (HPC)
- Information and Communication Technology for Development (ICT4D)

### Contact Details

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## HIGHLIGHTS

### Initiatives

The Department of Computer Science aims to be the premier computer science department within Africa and make contributions to the discipline at a global level. To that end, we are constantly evolving our undergraduate, postgraduate and research capabilities, to produce and attract good students and staff to UCT. Some of the most recent initiatives are:

The Hasso-Plattner Institute Centre in ICT4D (ICT for Development) was founded as a focal point for researchers who wish to create ICT appropriate to the needs of the developing world. The Centre is now multi-disciplinary and, under the Directorship of Prof Gary Marsden, explores ways of bringing ICT solutions to technologically impoverished regions. The Centre is already making a name for itself globally, and Profs Marsden and Blake were among 25 world leaders in the field invited to the Workshop on Computer Science and Global Development (USA) where the new ACM SIGDEV was created.

The Industrial Advisory Board was reconstituted with a number of senior executives from the IT industry and from local government invited to participate. A very successful inaugural meeting of the new Advisory Board was held in November under the chairmanship of Greg Reis from BSG. Our BSc(Hons) in Computer Science, and our Business Science Honours in Computer Science, are now accredited by the British Computer Society. Advisory Board input and our regular accreditation visits from the BCS assist us in maintaining our high standards.

Dr Anne Kayem was appointed as a new senior lecturer in the department at the end of the year. Anne received her PhD in computer security from Queens University in Ontario, and subsequently joined the German Artificial Intelligence Research Centre before accepting the position at UCT.

The Department hosted the African leg of the Global Game Jam in January. This event involved teams creating computer games over a weekend which were then uploaded to the Web for the international gaming community to enjoy and to rate. The games produced by our three student teams were very well received, as can be seen at [www.globalgamejam.org](http://www.globalgamejam.org).

The department mounted a new Honours module on Information and Communications Technology for Development, covering computer science research and development for third world nations.

### Awards and Recognition

Three academic members of staff were promoted in recognition of their outstanding overall contribution to teaching, research, leadership and social responsiveness. Drs Gain and Suleman were promoted to Associate Professor and Assoc. Prof. Gary Marsden was promoted to full Professor. Prof Pieter Kritzing retired at the end of the year and became the first Emeritus Professor of Computer Science at UCT. Dr Audrey Mbogho was granted tenure, and Dr Andrew Hutchison from T-Systems was re-appointed as Adjunct Professor in Computer Science.

Prof Gary Marsden received the Distinguished Teachers Award, the highest award made by UCT in recognition of excellence in teaching. Also a recipient of the Apple Distinguished Teachers Award, Gary's superb lecturing continues to receive exceptional praise from students, as well as researchers who attend his tutorials at international conferences; he is also well known worldwide as author of the leading textbook on mobile interaction design.

Terri Grant and Claudia Kalil of UCT's Professional Communications Unit received a CHED Award for their Computer Science 3 module. This involved scenario-based learning using UCT's ICT infrastructure renewal project, SupaTsela, with students presenting their findings in reports and oral presentations to external experts.

# STAFF

## Staff of the Department

### Head of Department

- Associate Professor Sonia Berman, BSc (Hons) Rhodes; MSc, PhD UCT.

### Professors

- Edwin Blake, BSc (Hons) Wits PhD London
- Pieter Kritzinger, MSc (Eng) Wits PhD Waterloo
- Ken MacGregor, BSc Strathclyde MSc Glasgow

### Adjunct Professors

- Andrew Hutchison, MSc HDE UCT PhD Zurich

### Associate Professor

- Gary Marsden, BSc (Hons) MSc PhD Stirling

### Senior Lecturers

- Antoine Bagula, MEng Louvain, MSc Stellenbosch, PhD KTH
- James Gain, MSc Rhodes PhD Cantab
- Michelle Kuttel, MSc, PhD UCT
- Hanh Le, PhD UTS
- Patrick Marais, MSc UCT DPhil Oxon
- Audrey Mbogho, MSc PhD CUNY
- Hussein Suleman, MSc UDW PhD VPI&SU

### Lecturers - Academic Development Programme

- Gary Stewart, BSc (Hons) UCT

### Computer Systems Managers

- Ademola Freddy Adekayode HND (Bida), PGD in computer Science (Bauchi) PGDM (Cape Town), MCP, ITSM – Systems Administrator (Windows)
- Craig Balfour BSocSci Cape Town, BA (SS) Hons UNISA – Systems Administrator (Unix)

### Administrative Officer

- Salegga Valley

### Administrative Assistant - Research

- Eve Gill

### Senior Secretary

- Jane Wright

### Receptionist / Laboratory Assistant

- Bernie Sam

## Professional Activities

### A Bagula

- Reviewer for the Optical Society of America and the IEEE, and for the journal Computer Networks.
- Programme committee member for international conferences such as INDS2009 (Austria), NGWMN 2009 (Austria) and BROADCOM 2009 (Poland).
- Lectures and wireless training activities at ICTP-ITU.

### S Berman

- Member of NRF Blue Skies Panel awarding research grants in IT and also of Blue Skies Moderation Panel awarding research grants across all disciplines.
- Member of NRF HICD Panel awarding research grants in IT for unrated researchers.
- Member of City of Cape Town/CHEC Focus Group on IT promoting collaboration in IT research and development for the city.
- Reviewer for ICEL-09, ICOODB 2009, SAICIST, SACLA and WWW2009 conferences and for South African Computer Journal and International Journal of Data and Knowledge Engineering.
- Selection committee member, Professorship of Computer Science at the University of the Western Cape.

### K MacGregor

- On sabbatical from January – December 2009.

### P Kritzinger

- South African representative on the IFIP Technical Committee for Telecommunications.
- Reviewer for the NRF and the Engineering and Physical Sciences Research Council (Britain); and for conferences such as MASCOTS (London), Networking 2009 (Germany), and Practical Applications of Stochastic Methods (England).

### J Gain

- Member of SIGGRAPH, ACM and the IEEE Computer Society
- Programme co-chair for Afrigraph 2009.

### M Kuttel

- On sabbatical from January – June 2009.
- Reviewer for the following journals: Journal of Chemical Theory and Computation, Journal of Theoretical Biology and Carbohydrate Research.
- Trustee and member of the Scientific Board of the South African Computer Olympiad.
- Presented lectures at the Centre for High Performance Computing and the African Institute of Mathematical Sciences, and hosted a two week Winter School in High Performance Computing for science and engineering students.

## H Le

- Patented wireless sensor network model in South Africa and internationally (patent pending).
- Reviewer for Journal of Information Science and Engineering, and for the 6<sup>th</sup> International Conference on Information Technology and Applications.
- Member of the programme committee for Healthcom 2009 international conference.

## P Marais

- Member of SIGGRAPH, ACM and IEEE Computer Society.
- President of Afrigraph (African Computer Graphics Association).
- Reviewer for ACM SIGGRAPH, IEEE Visualization, Afrigraph, IADIS Computer Graphics and Visualization, and SAICSIT conferences, and for SACJ and The Visual Computer journals.
- NRF Scholarships Committee member, awarding Masters and PhD scholarships nationally.

## G Marsden

- Invited speaker, Munchner Kreiss ICT4D, Berlin (presentation to high-level German government and industrialist group who set national policies on various issues, in this case on ICT4D).
- Presented keynote talk at ESPRC meeting in Cambridge, UK, on Bridging the Global Digital Divide.
- Invited speaker, Hasso Plattner Institute conference on Cloud Computing. Potsdam, Germany.
- Vice president of SAICSIT. Member ACM SIGCHI.
- Board member of Cell-Life, an NGO promoting HIV/AIDS awareness.
- Reviewer for numerous local and international conferences and journals, and column editor for ACM Interactions.
- Computer Science Editor of the South African Computer Journal.
- Presented tutorial on mobile interaction design in Boston at the ACM CHI Conference.

## H Suleman

- Elected to Senior Member of ACM
- Member of SAICSIT council
- Steering committee member of the National ETD project
- Commissioned to develop National Electronic Theses and Dissertations metadata repository and portal for South Africa by NRF
- African representative on the board of directors of the Networked Digital Library of Theses and Dissertations.
- Maintains the Bleek and Lloyd online collection of bushman drawings and notes, the website of the Sivuvile project that promotes Open Access in Southern Africa, and the BOINC server that hosts scientific projects in Africa (in collaboration with Africa@Home and funded by CERN).
- Reviewer for 15 local and international conferences and journals, including all major international conferences in the field of Digital Libraries.
- Successfully led a bid for the International Symposium on Electronic Theses and Dissertations (ETD2011) to be hosted in Cape Town in 2011.

## University Activities

### S Berman

- Information Technology Programme Convenor
- Member of Dean's Advisory Committee
- Member of UCT's Science Academic Development Programme Review Panel
- External examiner of Computer Science at Rhodes University (all courses), and of selected courses at UWC, Pretoria University and UNISA.
- Selection committee member for Statistics and Computer Science lectureships at UCT.

### H Suleman

- Member of various selection committees in faculty
- Chair of transformation committee (and representative on associated University committees)
- Chair of readmissions appeal committee (and representative on associated Senate committee)

### J Gain

- Serve on the CUES (Committee for University Education in Science) and the ICT Users Group
- Health and Safety Officer

### M Kuttel

- Departmental Student Advisor and, in that role, formed part of the Faculty Examination Committee.

### H Le

- Member of Faculty Library Committee

### P Marais

- Served on BSc(IT) programme committee
- Member of Science Faculty IT Equipment committee
- Member of CUES (committee for university education in Science)

### G Marsden

- ICT4D Centre: The Computer Science Department now has its first university accredited research centre in the form of the form of the ICT4D Research Centre. This centre has been set up to create an interdisciplinary group of research from across the university to look at how ICT technology may be used to aid development in Africa. The centre has run a series of seminars led by departments such as Information Systems, Centre for Educational Technology, Film and Media, and Computer Science. From March 2009, the centre has also hosted the Hasso Plattner Research School in ICT4D. This initiative supports African PhD candidates who are undertaking ICT4D research.
- Member of the faculty Marketing Committee.
- Member of the faculty Research committee.
- Student advisor
- Summer School Anniversary Committee; CET Advisory Board

## Staff Development

M Kuttel

- Attended a number of the Emerging Researcher Programme seminars.

A Mbogho

- Attended several Emerging Researcher Programme workshops



The Vice Chancellor and Dean of Science with staff promoted in 2009. Drs. Hussein Suleman (far left) and James Gain (fourth from left) are from Computer Science. Absent: Prof. Gary Marsden.



- Terri Grant and Claudia Kalil, above, received a CHED Award from UCT for the Professional Communications module they teach Computer Science 3 students.

## VISITORS

### Hosted Visitors

- David Levin; February 14-21, 2009 University of Israel.
- Nic Bidwell (James Cook University),
- Jonathan Donner (Microsoft Research)
- Paola Cescutti and Roberto Rizzo from the University of Trieste, Italy.

### Colloquia

The following visitors gave seminars in the Department:

- Speaker: Ian Tunbridge PhD Student, University of Cape Town  
Topic: "GPU Programming for Simulation"
- Speaker: J.P. Longmore- PhD Student, University of Cape Town  
Topic: "Towards Realistic Interactive Sand: A GPU-based Framework".
- Speaker: Prof David Levin, Tel Aviv University, Israel.  
Topic: Parameterization-free Projection for Geometry Reconstruction.
- Speaker: Dr. James Gain, the University of Cape Town  
Topic: Terrain Sketching.
- Speaker: Prof. Heinz Rüther, Emeritus Professor, Geomatics at the University of Cape Town,  
Topic: Visualisation and 3D Monitoring of African Cultural Heritage Sites and Landscapes
- Speaker: Dr Andrew Herbert, Microsoft Research Limited, Cambridge, UK
- Speaker: Juan-Pierre Longmore, the University of Cape Town  
Topic: Towards Realistic Interactive Sand:A GPU-based Framework
- Speaker: Mr Blaise Thomson, a PhD student from the University of Cambridge.  
Topic: The application of cognitive user interfaces to spoken dialogue systems
- Speaker: Dr Anne Kayem  
Topic: "Self-Adaptive Access Control".
- Speaker: Dr Zeyar Aung  
Topic: MatAlign - Precise Protein Structure Comparison by Matrix Alignment
- Speaker: Professor Eric Allender. Rutgers University, the State University of New Jersey  
Topic: Circuit Complexity meets the Theory of Randomness
- Speaker: Prof. Dr. Jürgen Sieck from the University of Applied Sciences Berlin (HTW Berlin).  
Topic: "Mobile Museum Information Systems - Potentials and Defiances of Mobile Devices"

Anyone wishing to join the departmental colloquium mailing list should email [hussain@cs.uct.ac.za](mailto:hussain@cs.uct.ac.za)

# RESEARCH

## Research Laboratories

### Advanced Information Management

<http://aim.cs.uct.ac.za>

Co-ordinator: Associate Professor S Berman. This laboratory deals with multiple facets of the information processing problem, exemplified by the following active research areas: databases; knowledge management systems; peer-to-peer computing; distributed computing and Web-based systems.

### Advanced Telecommunications Research

<http://www.cs.uct.ac.za/Research/ATR/>

Co-ordinators: Dr A Bagula and Dr H Le. Topics of interest include Smart Networking using Cars, Robots, UAVs, Sensors, Actuators and RFID tag-enabled devices; Traffic and Network Engineering for Next Generation IP Networks and Overlay networks; Efficient Frequency Management using cognitive Radio; Pan African Research and Education Network Infrastructures and Bandwidth Limitation and Information Accessibility in Developing Countries; Distributed Healthcare Data Networks; and Mobile Applications for the Developing World.

### Collaborative Visual Computing

<http://www.cs.uct.ac.za/Research/CVC/>

Co-ordinator: Professor E Blake. Topics of research include: Collaborative Virtual Environments; Usability and Human-Computer Interaction; Computer Graphics; Image Analysis applied to Medical Images; Virtual Reality and Behavioural Therapy; Allowing End-Users to Create Interesting Virtual Environments; Interaction with Mobile Computing Devices; Scalable Interfaces; and implications of these for Government Information Technology Policy. Special interests within the CVC lab include Socially Aware Computing, VR Methodology, Virtual Environments and the Geometry Interest Group.

### Data Network Architectures

<http://www.cs.uct.ac.za/Research/DNA/>

Co-ordinator: Professor P Kritzinger. Work in the DNA group focuses on the specification and analysis of computer protocols and associated software as well as fixed line communication networks. The group's main research interests lie in the security, correctness, performance analysis, design, specification and modelling of stochastic concurrent communicating systems (SCCS) in general, and telecommunication systems in particular.

### Digital Libraries

<http://www.cs.uct.ac.za/research/dll/digital-libraries-laboratory>

Co-ordinator: Ass Professor H Suleman. Research areas covered within digital libraries include information storage and retrieval; multilingual retrieval; Web-based systems; scalable and flexible repositories; interoperability and protocols; component-based systems; Open Access; and cultural heritage preservation.

## High Performance Computing

<http://www.cs.uct.ac.za/Research/HPC/>

Co-ordinator: Dr M Kuttel. This laboratory hosts investigations into all aspects of high performance and high throughput computing, including: parallel architectures and algorithms; scientific computing; high performance visualisation; large-scale information retrieval; high-performance digital archives; grid and volunteer computing; software optimization; and multi-core and GPU programming.

## ICT for Development Centre

<http://www.ict4d.cs.uct.ac.za/>

(Director: Professor G Marsden). The UCT Centre in ICT for Development seeks to create ICTs that are appropriate for developing nations. To date, most innovation in ICT has been driven by the developed world to meet challenges originating from that context. This centre will design, create and evaluate technologies that address the needs of the developing world and the people who live there.



Sylvian Gitau shows guests the Snap-send-grab board at the opening of the Hasso-Plattner Institute.

## Research Funding

|               |                       |
|---------------|-----------------------|
| NRF           | R 746 131.00          |
| URC           | R 160 201.00          |
| HPI           | R 235 384.00          |
| SANPAD        | R 182 700.00          |
| T-SYSTEMS     | R 50 000.00           |
| NRF INCENTIVE | R 200 000.00          |
| COE THRIP     | R 297 502.00          |
| COE IND       | R 358 999.00          |
| <b>TOTAL</b>  | <b>R 2 230 917.00</b> |

## Editorships and Conference/Workshop Organisation

### J Gain

- Afrigraph 2009 programme co-chairperson

### M Kuttel

- Organised the UCT-CHPC GPU workshop at CHPC national meeting in Sandton, 10-11 December, 2009.
- Helped with the organisation of the UCT-CHPC Algorithm Camp for school goers at UCT, 16-20 December, 2009.

### P Marais

- Afrigraph 2009 organisation
- Siggraph 2009 - international Resources Committee

### G Marsden

- Workshop on HCI for Development, Berkeley, California
- Co-organisator of Globi-comp 2009 conference.

## Publications

### Journals

Bagula, Antoine (2009) Improving The Resilience of Emerging Generation GMPLS Networks. *IEEE/OSA Journal of Optical Communication and Networking* 1(2):A56-A68.

Bagula, Antoine, Gordon Inggs, Simon Scott and Marco Zennaro (2009) On The Relevance of Using Open Wireless Sensor Networks in Environment Monitoring. *Sensors* 9(6):4845-4868.

Cross, Simon, Michelle Kuttel, John Stone and James Gain (2009) Visualisation of cyclic and multi-branched molecules with VMD. *Journal of Molecular Graphics and Modelling* 28(2):131-139.

Gain, J and Hultquist, C.(2009) An Adjectival Interface for Procedural Content Generation. *Intelligent Computer Graphics* 240(2009):143-165.

Le, Hanh, Nina Schiff, Johan du Plessis and Doan Hoang (2009) A Pervasive Tele-health System for continual and low intrusive monitoring using Peer-to-Peer Networks. *International Journal Computer Applications in Technology* 34:330-334.

Neeser, Rudolph, Rebecca Rogers Ackermann and James Gain (2009) Comparing the accuracy and precision of three techniques for estimating missing landmarks when reconstructing fossil hominin crania. *American Journal of Physical Anthropology* 140(1):1-18.

Nyirenda, Mayumbo, Hussein Suleman, Andrew Maunder and Reinhardt van Rooyen (2009) X-Switch: An Efficient, Multi-User, Multi-Language Web Application Server. *South African Computer Journal*(44):57-68.

Zawaira, Alexander , Marco Gallotta, Natasha Beeton-Kempen, Lauren Coulson, Patrick Marais, Michelle Kuttel and Johnathan Blackburn (2009) Exhaustive computational search of ionic-charge clusters that mediate interactions between mammalian cytochrome P450 (CYP) and P450-oxidoreductase (POR) proteins. *Computational Biology and Chemistry*.

## Conference Papers

Balikuddembe, Joseph and Antoine Bagula (2009) Aligning the software project selection process with the business strategy; a pilot study. In *Proceedings ASEA2009 Conference, Lecture Notes in Computer Science*, Jeju Island, Korea. ISBN 9783642106187

Balikuddembe, Joseph and Antoine Bagula (2009) Business viability assessment of potential software projects: an empirical study with the CASSE Framework. In *Proceedings ASEA2009 Conference, Lecture Notes in Computer Science*. ISBN 9783642106187

Balikuddembe, Joseph, Ulrike Rivett and Antoine Bagula (2009) Complexity management of customization requests on software products; A value-based Approach. In *Proceedings International Conference on Software Technology and Engineering (ICSTE 2009)*, Chennai, India. ISBN 9783642106187

Berman, S, M Kamkuemah and J Muntunemuine (2009) Integrated Query of the Hidden Web. In Van Brakel, P.A., Eds. *Proceedings 11th Annual Conference on World Wide Web Applications*, pages 4-15, Port Elizabeth, South Africa. ISBN 9780620452151

Blake, E H (2009) Design Doctorate in Computing: a defence of "doing cool stuff". In *Proceedings SACL A 2009*, Mpekweni Beach Resort. ISBN 9781605586830

Blake, Edwin H. (2009) Computer Science and Global Development. In Parikh, Tapan, Muneeb Ali, Lakshmi Subramanian and Bill Thies, Eds. *Proceedings CCC Workshop on Computer Science and Global Development*, Berkeley, CA.

Chong, Ming Ki and Gary Marsden (2009) Exploring the Use of Discrete Gestures for Authentication. In *Proceedings INTERACT 2009, 12th IFIP TC13 Conference in Human-Computer Interaction*, pages 205-213, Uppsala, Sweden. ISBN 9783642036546

De Kadt, C , J Gain and P Marais (2009) Revisiting district six: a case study of digital heritage reconstruction from archival photographs. In *Proceedings Proceedings of the 6th International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa (Afrigraph 09)*, pages 13-21, Pretoria. ISBN 9781605584287

Elliott, Charlene, Gary Marsden, Marion Walton and Edwin Blake (2009) Design Notations for Creating Virtual Environment. In *Proceedings SAICSIT 2009*, pages 7-15. ISBN 9781605586434

Gain, James, Patrick Marais (2009) Terrain Sketching. In *Proceedings I3D2009: The 2009 ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games*, pages 31-38, Boston, Massachusetts, USA. ISBN 9781605584294

Gitau, Shikoh, Jonathan Donner and Gary Marsden (2009) i-Internet? Intle. In *Proceedings 3rd International IDIA Development Informatics Conference*, pages 196-210, Kruger Park, South Africa. ISBN 9780620450379

Gitau, Shikoh and Gary Marsden (2009) Working with NGOs through Fair Partnerships. In *Proceedings Interact*, pages 205-213, Uppsala, Sweden. ISBN 9783642036546

Gain, J and Hultquist, C. (2009) An Adjectival Interface for Procedural Content Generation. In *Proceedings 31A '2009: the 12th International Conference in Computer Graphics and Artificial Intelligence*, pages 105-114, Athens, Greece. ISBN 9782914256116

King, Samuel and Audrey Mbogho (2009) Evaluating the usability and suitability of mobile tagging media in educational settings in a developing country. In *Proceedings IADIS International Conference on Mobile Learning*, pages 230-234, Barcelona, Spain. ISBN 9789728924362

Le, Hanh, Andre Scholtz and Anet Potgieter (2009) A structured framework for agents to facilitate intelligent Wireless Sensor Networks. In *Proceedings The 12th International Conference on Network-Based Information Systems*, Indianapolis, USA. ISBN 978769537672

Merry, B, P Marais and J Gain (2009) Analytic simplification of animated characters. In *Proceedings Proceedings of the 6th International Conference on Computer Graphics, Virtual Reality, Visualisation and Interaction in Africa (Afrigraph 09)*, pages 37-45, Pretoria. ISBN 9781605584287

Mokhesi, Lekometsa and Antoine Bagula (2009) Context-Aware Handoff Decision for Wireless Access Networks using Bayesian Networks. In *Proceedings Conference of Southern African Institute for Computer Scientists and Information Technologists (SAICSIT)*, Johannesburg, South Africa.

Mugwanya, Raymond and Gary Marsden (2009) Mobile Learning Content Authoring Tools (MLCATs): A Systematic Review. In *Proceedings 1st International ICST Conference on e-Infrastructure and e-Services for Developing Countries*, Maputo, Mozambique. ISBN 9789639799851

Nakashole, Ndapandula and Hussein Suleman (2009) A Hybrid Distributed Architecture for Indexing. In *Proceedings 13th International Conference on European Digital Libraries (ECDL)*, Corfu, Greece. ISBN 9783642043451

Ogunleye, Samuel and Gary Marsden (2009) Supporting Mobile Applications Developer through Java IDE Using Contextual Inquiry. In *Proceedings 2009 World Congress on Computer Science and Information Engineering*, pages 770-774, Las Vegas.

Osunmakinde, I O and A Bagula (2009) Supporting Scalable Bayesian Networks Using Configurable Discretizer Actuators. In Kolehmainen et al., M. , Eds. *Proceedings ICANNGA 2009* 5495, pages 323-332, Finland. ISBN 9783642049206

Osunmakinde, I O and A Bagula (2009) Emergent Future Situation Awareness: A Temporal Probabilistic Reasoning in the Absence of Domain Experts. In Kolehmainen et al., M. , Eds. *Proceedings ICANNGA 2009* 5495, pages 340-349. ISBN 9783642049206

Osunmakinde, Isaac O and Antoine Bagula (2009) Emerging Situation Awareness of Drivable Routes for Autonomous Robots Using Temporal probabilistic Reasoning. In *Proceedings 14th IASTED International Conference on Robotics and Applications* 664(094), Cambridge, Massachussets, USA. ISBN 9780889868137

Patel, Dynal, Gary Marsden, Matt Jones and Steve Jones (2009) An Evaluation of Techniques for Image Searching and Browsing on Mobile Devices. In *Proceedings SAICSIT 2009*, pages 60-69. ISBN 9781605586434

Poulo, Lebeko, Jorgina Paihama and Marwan Mohammed Noor (2009) Preserving Endangered Languages using a Layered Web-based Archive. In van Brakel, P A, Eds. *Proceedings 11th Annual Conference on WWW Applications (ZA-WWW 2009)*, Port Elizabeth. ISBN 9780620452151

Marsden, Gary, (2009) Mobile Digital Storytelling. In *Proceedings Interact*, pages 750-753, Uppsala, Sweden. ISBN 9783642036546

Salami, O, H A Chan and A Bagula (2009) Link and Route Availability for Inter-working Multi-hop Wireless Networks. In *Proceedings IEEE NGWMN 2009 workshop*, Vienna, Austria. ISBN 9780769538037

Salami, Oladayo, Antoine Bagula and Anthony Chan (2009) A Connectivity Model for Inter-working Multi-hop Wireless Networks. In *Proceedings Southern African Telecommunications Networks and Application Conference (SATNAC 2009)*. ISBN 9780620441063

Schraefel, mc, P Andre, R White, T Berners-Lee, S Consolvo, R Jacobs, I Kohane, C Le Dantec, L Mamykina, G Marsden, B Shneiderman, P Szolovits and D Weitzner (2009) Interacting with eHealth: towards grand challenges for HCI. In *Proceedings Human Factors in Computing Systems - ACM SIGCHI 2009 2*, pages 3309-3313, Boston. ISBN 9781605582467

Suleman, Hussein (2009) Utility-based high performance digital library systems. In Ioannidis, Yannis, Paolo Manghi and Pasquale Pagano, Eds. *Proceedings Second Workshop on Very Large Digital Libraries (VLDL 2009)*, pages 1-8, Corfu, Greece. ISBN 9788888506852

Symington, A and PS Kritzinger (2009) A Hardware Test Bed for Measuring IEEE 802.11g Distribution Coordination Function Performance. In *Proceedings 2009 IEEE International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (MASCOTS)*, pages 61-67, London. ISBN 9781424449279

Zennaro, M and A Bagula (2009) Design of a flexible and reliable gateway to collect sensor data in intermittent power environments. In *Proceedings IEEE ICCCN2009*. ISBN 9781424445813

Zennaro, M, G Dogan, Z Cao, M Bahader, H Ntareme and A Bagula (2009) On the design of a Water Quality Wireless Sensor Network (WQWSN): an Application to Water Quality Monitoring in Malawi . In Mieso, Denko, Eds. *Proceedings IEEE NGWMN 2009*, Vienna, Austria. ISBN 9780769538037

## Conference Posters

Zennaro, M, S Scott, G Inggs, H Ntareme and A Bagula (2009) On the relevance of Open Wireless sensors for NGN. In *Proceedings ITU-T Kaleidoscope*.

## Departmental Technical Reports

Baxter, Richard Jonathan (2009) Generating Hidden Structure for Procedural Scenes. Technical Report CS09-05-00, Department of Computer Science, University of Cape Town.

Crumley, Zacharia (2009) Automatic Creation of Physics Components for Procedurally Generated Trees. Technical Report CS09-04-00, Department of Computer Science, University of Cape Town.

Paihama, Jorgina K. do R. and Hussein Suleman (2009) A Survey of the Effectiveness of Current Interoperability Protocols. Technical Report CS09-03-00, Department of Computer Science, University of Cape Town.

Pileggi, Paolo, Giuseppe Iazeolla and Pieter Kritzing (2009) The IEEE802.16d Fixed WMAN – a definitive description of the network to be simulated. Technical Report CS09-01-00, Department of Computer Science, University of Cape Town.

Symington, Andrew and Pieter Kritzing (2009) A Hardware Test Bed for Measuring IEEE 802.11g DCF Performance. Technical Report CS09-02-00, Department of Computer Science, University of Cape Town.

## Other Conferences, Workshops and Excursions

### M Kuttel

- Presented 3 talks at the American Chemical Society Fall 2009 National Meeting and Exposition Washington D.C., USA

### P Marais

- Afrigraph 2009, Pretoria, Jan 2009

### G Marsden

- Workshop on HCI for Development, Berkeley, California

### A Mbogho

- Presented a paper at IADIS International Conference on Mobile Learning, Barcelona, Spain, 26-28 February 2009

### J Gain

- Afrigraph 2009, Pretoria, Jan 2009
- ACM SIGGRAPH Symposium on Interactive 3D Graphics and Games, Boston, Feb to Mar 2009
- Center for High Performance Computing Workshop, Johannesburg, Dec 2009

## Industrial Collaboration

- Apple Computers: The Department is working with Apple to investigate how cell phones can be used as an education delivery platform.
- Black Ginger: The Department undertakes joint research and development projects covering parallel rendering algorithms and animation techniques with Black Ginger a local animation and graphics company.
- BSG donated new prizes for the best Computer Science students, to be awarded annually. Recipients for 2009 are as follows: BSG Prize for Computer Science 2 to Neil Goldberg; BSG Prize for Computer Science 3 to Johannes Du Plessis; BSG Prize for Computer Science Honours to Julian Kenwood, and BSG Honours Project Prize to Richard Baxter and Zacharia Crumley.
- IBM: Established a LINUX Competency centre at UCT which is operated by the Computer Science Department. It is used for commercial and parallel computing projects.
- Microsoft Research: The Department is involved in projects with Microsoft research, which cover mobile communications and wireless technologies.
- Nokia Research: The Department undertakes research in the use of mobile technology in disadvantaged communities with Nokia.
- TELKOM, Nokia Siemens: The Department participates in the UCT TELKOM Centre of Excellence which is jointly sponsored by Nokia and Siemens. The area of research is broadband communications, convergence of wireless and wired networks and Telesciences.
- T-Systems: The Department has a security research laboratory sponsored by T-Systems. Prof. Hutchison who heads this research group and lectures in network security is Head of telecommunication services at T-Systems.



The Merit Students Function, and Jason Brownbridge receiving the Best Honours Student Award from Gary Stocks of BSG.

## Advisory Board

The department's Advisory Board was reinstated in 2009. In the past this body had been instrumental in achieving many benefits for the department such as the COMPASS programme which funded IT study for underprepared scholars, UCT's Information Technology Thrust, and curriculum innovations such as the introduction of a business course and professional communication modules. The Advisory Board consists of senior people from businesses, industries and local government that are associated with the Department. Its role is to give input on the relevance of our curriculum and research from an industry perspective, and to assist with strategic planning. In return, members have access to our students and our research, and the ability to guide us in producing graduates that meet industry needs.

At the inaugural meeting in November, an overview of the department was followed by formal adoption of the Advisory Board Charter. Discussions centred on ways of attracting more students to Computer Science so as to meet the serious marketplace shortage, as well as a number of curriculum matters. These ranged from content detail to strategies for maintaining our specialised degree programmes in Computer Games Design, Computer Engineering and Business Computing when the BSc moves away from programmes in 2010. The meeting was followed by an opportunity to view Honours student project demonstrations.

The Computer Science Advisory Board comprises all academic staff of the department as well as the following members:

- Greg Reis, BSG (Chair)
- Doug Batchelor , Microsoft
- Jo Beall, UCT (Deputy Vice Chancellor)
- Marc Bloch and Hilton Treves, Black Ginger
- Andrea Bohmert, Hasso Plattner Ventures Africa
- Kathy Driver, UCT (Dean of Science)
- Izak Janse van Rensburg, UCT (Head of ICT Services)
- Jo-ann Johnston, Cape Provincial Government
- Danie Kok, SAP Africa
- Jenny McKinnell, Cape IT Initiative
- Donovan Muller, Accenture
- Craig Saks , S1 Corporation
- Andre Stelzner, City of Cape Town
- Brendon Wilson, Standard Bank

# TEACHING

## Postgraduate Students

### Graduates in 2009

#### PhD in Computer Science

- Kelleher, Justin. "Traceability in Software Engineering" (Gary Marsden)
- Vermeulen, Hendranus. "Activity Theory and Constructivism" (Edwin Blake)
- Tucker, Bill. "Softbridge: ICT4D" (Edwin Blake)
- Hultquist, Carl . "An Adjectival Interface for Procedural Content Generation" (James Gain)
- Balikuddembe, Joseph. "Managing economic value and uncertainty on software projects; an empirical study with the CASSE Framework" (Antoine Bagula)
- Osunmakinde, Isaac. "Computational Intelligent Systems: Evolving Dynamic Bayesian Networks" (Antoine Bagula)

#### MSc in Computer Science

- JP Longmore "Towards Realistic Interactive Sand: A GPU-based Framework" (distinction) (Patrick Marais)
- David Jacka "High-Level Control of Agent-based Crowds by means of General Constraints" (James Gain)
- Ming Ki Chong, (distinction) "Gesture Based Authentication" (Gary Marsden)
- Shikoh Gitau, "Information Sharing and NGOs" (Gary Marsden)
- Peter McMaho. "Accelerating Bioinformatics Applications using Reconfigurable Computers" (distinction) (Michelle Kuttel)
- Ashley Reid "Practical Fluid Dynamics for the Animation Industry Principal" (James Gain)
- Grace Kamulegeya "A Bluetooth Educational Content Distribution System Modelled on Service Oriented Architecture" (Gary Marsden and Michelle Kuttel)
- Alex Karpul "Emergent Communication: the Evolution of Simplistic Machines using Different Communication Types" (Anet Potgieter and Patrick Marais)
- Marlon Paulse "Data Replication and Update Propagation in XML p2p Data Management Systems" (distinction) (Sonia Berman)
- Nakashole, Ndapandula, "A Hybrid Scavenger Grid Approach to Intranet Search" (distinction) (Hussein Suleman)
- Parker, Christopher P, "A lightweight interface to local Grid scheduling systems" (Hussein Suleman)
- Symington, Andrew, "A Hardware Testbed for Measuring IEEE 802.11g DCF Performance" (Pieter Kritzing)

#### Masters in Information Technology

- Hector Jason, " Harnessing Open Sound Control for Networked Music in VST Systems" (K MacGregor)
- Mogomotsi Banabotlhe "System Requirements for Service Quality Appraisal System (SQAS) to be used in Commercial Banks by Blind Customers"

### Honours in Computer Science

The department graduates the highest number of Honours qualifiers in the Faculty. Two students graduated with a BSc Honours in Information Technology and 30 students graduated with a BSc Honours in Computer Science. The latter is the degree which is accredited by the British Computer Society: these qualifiers must have obtained both BSc and Honours degrees in this department, and must moreover have obtained a high mark for their Honours project. There were also 2 students graduating with a Bachelor of Business Science Honours in Computer Science, our 4-year Commerce degree that is also accredited by the British Computer Society. Of these 34 Honours graduates, 11 obtained the degree with distinction.

The following is a list of all Honours projects with the students who were members of each project group.

1. A Highly Scalable Monitoring Tool for a Network of Wi-Fi Hotspots: Pheeha Machaka
2. An Investigation of South African Accents in Speech Recognition: Michelle Katz, Neann Mathai, Heather Sobey
3. Asset Tracking : Julian Hulme, Collin Murray
4. AudioEye : Jake Hazell, Dominic Nunes, Jonathan Page
5. Bushman OnLine Dicitonary: Sanvir Manilal, Lebogang Molwantoa, Kyle Williams
6. CALJAX : Marc Bowes, Matthew Hirst, Suraj Subrun
7. Data MULES and ad hoc WMNs : Edmundo Chissungo, Xoluqobo Mkhwanazi
8. Dynamic Content in Procedural Generation : Richard Baxter, Zacharia Crumley
9. E-Gov for Water and Energy Conservation : Hilja Angula, Mogamed Ashiq Khan, Morithla Madisha
10. Electronic Health Care Monitoring System : Sena Allen, Gregory Chandran, Robert Koletka
11. Environmentally Aware Game Bots : Wesley King, Gina Morris, Michael Talbot
12. MXit Web Applications : Jared Baboo, Jason Wedepohl
13. Social Networks - GetCoffee.co.za : Lario Borges, Adrian Seady
14. Water Compression : Keegan Carruthers-Smith, Julian Kenwood, Min-Young Wu

### New and Continuing Students in 2009

#### PhD in Computer Science

1. Simon Perkins, "Interpretation of 3D Spaces " (James Gain)
2. Chen Wei, "Volumetric Cloud Generation by Sketching" (James Gain and Patrick Marais)
3. Munier Parker, "Cellular Application Design" (Gary Marsden)
4. Jakkaphan Tangkuampien, "ICT in the Classroom" (Gary Marsden)
5. Andrew Maunder, "ICT4 Development" (Gary Marsden)
6. Ilda Ladeira, "Interactive Storytelling in Museums" (Gary Marsden)
7. Raymond Mugwanya, "Digital Learning Materials" (Gary Marsden)
8. Olutayo Boyinbode, "Efficient Wireless Sensor Networks" (Hanh Le)
9. James Lane, "Viewing Layered Surfaces through Animated Particles" (James Gain)
10. Rudolph Neeser, "Procedural Methods for the Modelling and Simulation of large Environments" (James Gain)
11. Cara Winterbottom, "VRBridge: A Constructivist Approach to Supporting Interaction Design and End-User Authoring in Virtual Reality" (Edwin Blake and James Gain)
12. Mohammed Mustafa Ali, "Language-aware Multilingual Information Retrieval" (Hussein Suleman)
13. Hisham Abdalla , "Improving Arabic-English Cross-language Information Retrieval by Exploiting Web Structure" (Hussein Suleman)
14. Mongezi Ngindana , "Comparative Analysis of Bandwidth Limitation and Information Accessibility in Developing Countries" (Hussein Suleman)

## MSc in Computer Science

1. Anton Eicher, "Active Shape Model Segmentation of Brain Structures in MR Images of Subjects with FASD" (Patrick Marais and Michelle Kuttel)
2. Keri Woods, "Tissue Segmentation of the Cerebellum from MR Images" (Patrick Marais)
3. Marco Gallotta, "Development and validation of a visualization tool for predicting protein-protein interfaces" (Michelle Kuttel)
4. Duncan Clough, "LBM Liquid Simulation with Dynamic Objects on a GPU" (James Gain and Michelle Kuttel)
5. Johannes Jansen van Vuuren, "Visualization of Multi-Dimensional Solution Sets" (Michelle Kuttel and James Gain)
6. Christopher Moolenschot, "Emergence in Artificial Intelligence for Games" (James Gain and Anet Potgieter)
7. Flora Tasse, "Distributed Texture-based Terrain Synthesis" (James Gain and Patrick Marais)
8. Warren Russell, "Dynamic Real-Time Character Motion" (James Gain and Patrick Marais)
9. Jason Brownbridge, "GPU Accelerated Crowd Modelling" (James Gain and Patrick Marais)
10. Ian Tunbridge, "Coarse-grained Simulation of Protein-Protein Docking with Macro-molecular Crowding Using Graphics Processing Units" (Michelle Kuttel and James Gain)
11. Sebastian Wyngaard, "Simulations of Realistic Hair: Dynamics, Interactions and Parallelisation" (James Gain and Michelle Kuttel)
12. Graeme Smith, "Mobile Media Distribution" (Gary Marsden)
13. Thomas Reitmaier, "Digital Storytelling" (Gary Marsden)
14. Ian Saunder, "Interactive Tag Clouds" (Gary Marsden)
15. Sean Packam, "Bluetooth Media Distribution" (Gary Marsden)
16. Andre Scholtz, "An intelligent Agent-based framework for Wireless Sensor Networks" (Hanh Le)
17. Karodia, Ramone, "Usable 3D Graphical User Interface for an Augmented Reality Desktop with a Wiimote-Based Head and Finger Tracker" (Audrey Mbogho)
18. Marwan Mohammed Noor, "An end-to-end solution for complex open educational resources" (Hussein Suleman)
19. Stefano Rivera, "Digital Asset Management in a Content Management System" (Hussein Suleman)
20. Jorgina Paihama, "Meta-standardisation of Interoperability Protocols" (Hussein Suleman)
21. Lebeko Poulou, "Cloud Computing for Digital Libraries" (Hussein Suleman)
22. Nils Körber, "Enhancing Usability of Open Source Digital Repositories" (Hussein Suleman)
23. Kieran Sharpey-Schafer, "An Investigation and Evaluation of Possible Solutions for a National Patient Record in South Africa" (Hussein Suleman)

## Masters in Information Technology (MIT)

The following list includes both students who are currently enrolled for coursework modules and those who have completed the coursework and are working solely on research.

1. Balfour, Craig (Sonia Berman)
2. Doyle, Gregory Earle (Audrey Mbogho)
3. Erasmus, Daniel (Edwin Blake)
4. Evans, Mathew Glen (Andrew Hutchison)
5. Eyal, Dror
6. Falcke, Dean
7. Fisher, Mario (Ken MacGregor)
8. Gordon, Marc
9. Gounden, Kevindhren (Gary Marsden)
10. Hebler, Norman
11. Hector, Jason Alexis (Ken MacGregor)
12. Idowu, Modupeola
13. Joseph, Asma
14. Koopman, Keith Malvern (Audrey Mbogho)

15. Letsoalo, Edward
16. Loubser, Christa
17. Makeketa, Frans (Audrey Mbogho)
18. Manchip, David (Audrey Mbogho)
19. Marquard, Stephen
20. Martin, Wickus (Gary Marsden)
21. Mashinini, Fortunate (Hussein Suleman)
22. Mogashana, Lucky Mokhine (Gary Marsden)
23. Mooketsi, Bojelo (Ken MacGregor)
24. Mwebaze, Anthony Kasaija (Antoine Bagula)
25. Nashenda, Hubert (Audrey Mbogho)
26. Nel, Marius (Hussein Suleman)
27. O'Loghlen, Gerald (Hanh Le)
28. Pather, Suhendran (Sonia Berman)
29. Siwela, Blessing (Sonia Berman)
30. Strauss, Johann (Hanh Le)
31. Timana, Lovely
32. Tlale, Lisemelo (Hussein Suleman)
33. Van Den Berg, Rudolf (Michelle Kuttel)
34. Van Niekerk, Kathryn (Hussein Suleman)

## The Information Technology Programme

The Assessment Panel of the British Computer Society rated our BSc and Honours in Computer Science very highly. Our student intake from 2008 onwards will thus be accredited by the British Computer Society with CITP (Chartered IT Professional) and Partial CSci (Chartered Scientist) after graduating.

Information Technology is one of four programmes in the UCT BSc degree. The other three are BEES (Biological, Earth and Environmental Sciences); CMCS (Chemical, Molecular and Cellular Sciences); and MPSS (Mathematical, Physical and Statistical Sciences). Computer Science thus has its own programme, while the other three programmes involve several majors and departments each. Nevertheless the IT programme is comparable in size to the other programmes.

Students in the IT programme choose between six specializations or specially-constructed curricula: Applied Computing, Bioinformatics, Business Computing, Computer Engineering, Computer Games Design and Computer Science. While only one specialization is required, 6 qualified with two specializations. In 2009 there were 11 qualifying with Computer Games Design, 12 with Business Computing and 8 with Computer Engineering. Of the 45 graduates, 8 were placed on the Dean's Merit List for excellent achievement, and 3 obtained the degree with distinction in Computer Science.

The programme as a whole comprised 288 students in 2009: 133 in first year, 94 in second year and 61 in final year. Of the final year students 34 graduated and 1 was excluded for lack of progress. The remainder continue their degree at UCT in 2010. There were many excellent results in the programme and altogether 36 IT students were placed on the Dean's Merit List, having obtained a distinction as their aggregate for the year. The BSG Prize for the best Computer Science 2 student was awarded to Neil Goldberg, the BSG Prize for the top Computer Science 3 student went to Johan Du Plessis, the BSG Prize for the top Computer Science Honours student was awarded to Julian Kenwood, and the BSG Prize for the best Computer Science Honours project went to Zac Crumley and Richard Baxter.

| Table 1: I.T. student data of 2009 compared to 2008 |      |      |
|---|------|------|
|   | 2008 | 2009 |
| New intake into first year I.T.                     | 71   | 79   |
| No. BSc(I.T.) graduates                             | 69   | 45   |
| No. graduating with Distinction in Computer Science | 9    | 3    |
| No. Dean's Merit List graduates in BSc(I.T.)        | 19   | 8    |
| Total No. Dean's Merit List students in BSc(I.T.)   | 44   | 36   |

| Table 2. Undergraduate and Honours Pass Rates. |       |      |        |      |                   |      |
|--|-------|------|--------|------|-------------------|------|
| Course   | Wrote |      | Passed |      | Percentage Passed |      |
|  | 2009  | 2008 | 2009   | 2008 | 2009              | 2008 |
| CSC1010H                                       | 85    | 87   | 48     | 59   | 58                | 68   |
| CSC1011H                                       | 30    | 19   | 19     | 13   | 64                | 68   |
| CSC1015F                                       | 360   | 291  | 267    | 233  | 75                | 80   |
| CSC1016S                                       | 183   | 134  | 130    | 126  | 72                | 82   |
| CSC1018F                                       | 15    | 23   | 14     | 22   | 93                | 96   |
| CSC2001F                                       | 134   | 127  | 99     | 96   | 74                | 76   |
| CSC2002S                                       | 110   | 105  | 81     | 89   | 75                | 85   |
| CSC2003S                                       | 40    | 38   | 28     | 22   | 74                | 55   |
| CSC3002F                                       | 61    | 84   | 58     | 74   | 95                | 88   |
| CSC3003S                                       | 69    | 93   | 53     | 77   | 77                | 83   |
| CSC3020H                                       | 13    | 25   | 12     | 25   | 92                | 100  |
| CSC4000W                                       | 33    | 24   | 32     | 24   | 97                | 100  |
| CSC4016W                                       | 3     | 10   | 2      | 10   | 67                | 100  |

### Academic Development

The Department continues to run an Academic Development Programme (ADP/GEPS), designed to assist talented, but under-prepared, historically-disadvantaged students who do not meet the standard admissions criteria of the University. The students on the ADP programme enrol for a four-year BSc, which includes 2 years of ADP courses, followed by the regular CS2 and CS3 courses. In general, statistics show that 20-30% of students admitted to the ADP programme finally pass CS3. Given the disadvantage, on entry to UCT, of ADP students, we view this as a high rate of success.



Neil Goldberg with his trophy for best Maths/Computer Science student; and Marco Galotta, Google Ambassador and driving force behind the Algorithms Circle promoting Computer Science at schools.

# FACILITIES

## Equipment

The Department maintains a network of UNIX and Windows based systems which are available for use by senior and graduate students. First year computing facilities are provided by the Science Faculty. The value of the current senior/graduate equipment base exceeds R2M. The available equipment includes:

### Servers

17 Machines running a variety of operating systems (Ubuntu Linux, FreeBSD, Microsoft Windows2003 Server) that provide Web, email, domain, file, print, research and other services to the department as a whole.

### Workstations

Approximately 200 workstations running various flavours of the Unix and Microsoft Windows including 76 workstations running a dual boot configuration of Microsoft XP and Ubuntu Linux and 47 diskless network computers running Ubuntu Linux.

### I/O Equipment

7 network laser printers, 2 high-resolution scanners and a range of digital cameras.

### Science First Year Laboratory

The Department is the major user of 150 Windows PCs in this laboratory. The current undergraduate student-to-machine ratio is about 4.5:1, which needs to be improved.

### Programs

The Department of Computer Science is a paid-up subscriber to the Microsoft Developer Network Academic Alliance program. The program allows the department and registered Computer Science students easy access to software from Microsoft.

### Free and Open Source Software

The Department makes extensive use of open source software, which is available at no cost, primarily under the GPL and BSD licenses. The types of software employed range from operating systems, to network infrastructure services, to word processing and typesetting suites.



Our Games Design degree in the Sunday Times, and Global Game Jam entrants in action in our Senior Laboratory.